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New England

BUSINESS REVIEW

JULY 1958

Research-Based Enterprises, Part I

Thriving in a Postwar Climate

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An engineer working for a firm making expensive equipment discovered a new principle for his company's product. The firm wasn't interested in the idea, and the engineer formed a company to develop it on his own. Eighteen months later he successfully tested the equipment, four and one-half years later got his first large production contract, and nine years later paid his first dividend to stockholders.

This is the brief history of a type of firm which bears the label of "new, research-based enterprise." These companies are founded by men who change from laboratory aprons to business suits to put their ideas into production. They come from the laboratories of both industry and campus.

New England has been a particularly fertile ground for research-based enterprises because of its many universities. There is no way of determining how many firms have come into existence since World War II, but rough estimates place the number at 300 to 400. Several dozen of these enterprises can be traced to Harvard University and Massachusetts Institute of Technology, which had heavy concentrations of scientific and engineering talent at the end of World War II. The

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formation of many companies coincided with the termination of wartime projects, and researchers shifted from campus to firm to carry on the same type of work.

The principal role of these new companies is to spur the development and production of specialized products for which they are particularly adapted and new products neglected by established corporations. Thousands of company laboratories are engaged in research and development, but many overlap in working on the same techniques.

This is where the technician-entrepreneur comes in. He sees a chance for development which others are neglecting, and starts his own firm. In the computer and aircraft fields, for example, many of the daring, new concepts come from new enterprises. Many of the radical new developments of the postwar period in electronic components, instruments, aircraft, packaging, computers, and metals processing have resulted from the efforts of industrial newcomers.

The new research-based firm adapts to new products because it has no investment in the past. It has no expensive equipment to protect, no markets to maintain.

The research-based firm capitalizes on its unique resources—its spirit, the technical skill of its principals, its ability to move fast and maneuver. The founders of these enterprises are closely identified with the work, which is the expression of their aspirations, personalities, and technical competence. They approach the problem with a vigor not frequently found in the large firm.

The small firm can profitably produce for a market too small to be economic for the large firm. Smaller enterprises have approached large companies for permission to manufacture products which the company was only carrying for the convenience of its customers. This had been particularly true in the chemical field, where one large company turned over 25 products to a small enterprise. This is the type of product in which the percentage of operating profit may be quite high, despite the low volume. It may be just the kind of product which the small, entering firm needs.

But small research-based firms have a number of disadvantages. They have all the problems of any small business, and then some.

One of the most difficult problems is the long lag in earning profits because of the time required to bring a product from laboratory to market. The small firm entering an established field immediately starts earning some revenue. The pioneering firm has no such assurance.

Even when the new product idea can be tested in the laboratory, five to ten years from development to marketability are not uncommon for complex equipment even in large firms. A small firm concentrating on a single development can perhaps reduce this time, but in the process it fails to build up sufficient supporting activities, such as marketing and production.

Another problem among these research-based firms is the lack of management experience. The founder is usually an engineer or scientist and has little interest in business management. If a business-trained person is brought in to manage the company the partnership is delicate. The manager may have little experience with technical problems, and the technician may distrust the judgment of the businessman. This scientist-businessman relation is one of the critical elements in the success of the research-based firm. It is important both within the company and in the company's dealings with the outside world.

Role of the New Firm

The most successful of the new research-based firms are those which start with a self-analysis of their capabilities to determine specifically what their economic role should be. The small firm cannot compete successfully in fields where massive financing, production, and marketing are essential.

Establishing the company's role will depend, first of all, on the stage of a product's development at which the firm comes into existence. Often a long period of additional research and development is needed for ventures started early in the applied research state. The ability of the entrepreneur to estimate his success is more limited at this stage.

As ventures are initiated at later stages of the research-to-market process, the chances of success improve. The size of the potential payoff diminishes, however, with the loss of advantages of being first.

The new firm must avoid both the dangers of specialization or over-diversification. Spreading too thin often constitutes suicidal conditions for a firm without the financial backing and management skill to conduct a number of diverse enterprises at once.

On the other hand, over-specialization is a particular danger for the research-based firm, whose managers may have narrow interests. If the firm is dedicated to a particularly narrow field, changes in the market may ruin it.

The successful firm sticks to what it knows best but is alert to the possibilities of applying that highly specialized field to related fields.

One firm reported that it regularly turns down bids to make standard electronic items. "Most of them," a company spokesman said, "are not in our line and would divert engineering and management talent away from our main endeavor, which has good future potential."

In determining its role in the economy, the new firm must also consider its growth rate. The fastest growth is not always the best for this particular type of firm. Explosive growth may extend the firm beyond its resources—its management capabilities, production know-how, and other skills that it cannot acquire quickly.

A means of growth which will probably increase is the merger with other new research-based enterprises. For example, one successful firm now looking for a merger has reached a $5 million sales volume, has a nationwide sales organization and seasoned management, and can provide up to $500,000 in working capital to exploit a new product.

Mergers have the advantages of pooling scarce resources, providing higher total volume, and increasing production efficiency. Frequently the companies bring different capabilities to the merger. One, for instance, may be strong in marketing, the other strong in research. The merger may offer each firm a chance to diversify without starting new ventures.

A serious consideration in mergers of this type of firm is the possibility for management conflict. Each of the research-based companies is probably run by independent-minded technical-entrepreneurs. The personalities of the principals of the two firms must be considered.

Many of the successful ventures are also faced with the possibility of merging with a larger firm, which usually means virtual absorption. The large company may be interested in the smaller firm because the large company is in the field and wants additional products and talent. In other cases a large company wants to enter a field and prefers one which a small company has already established.

The questions which the small firms ask in considering the merger is, "How much freedom will it have in its continued operation? What future will the managers of the firm have in the larger company?"

The small firm often receives stock of the large firm in the merger, but it constitutes a small block in a large company. Managers of the small firm cannot directly relate their efforts to the larger firm's growth. In one instance, a firm retained semi-independence by an exchange of stock which relinquished majority of equity but maintained control. Stock was divided into voting and non-voting, with the small firm retaining the majority of voting stock.

One firm holds a view concerning management which is not common among these firms. It feels that actual control is determined by competence and that financial control is not important. As long as the manager is successful, he won't be replaced or pushed around. The majority of the enterprises, however, abhor the thought of being managed by people who are not technically competent, as often happens in mergers with non-technical companies. In one case the company tried to run the new firm from a distance but had no experience in the highly technical field. Its policy declarations resulted in mass defections of the principals of the new firm.

Effects of Government Contracts

The growth problems of many research-based firms are quite different from the ordinary small firm because of the reliance on the government contract. Indeed, many of these firms are in existence because of their ability to produce items under government contract, usually for the defense program.

During the life of the original contract the firm could prepare bids and begin to develop commercial items. Initial investments are small under government contracting, and continued credit is generally assured.

Government contracting has its obvious pitfalls—pitfalls similar to those of overdependence on any one customer. But contracting also raises the question of its effects in terms of the potential social role of the research-based enterprise. The security of the contract makes it difficult for the firm to carry out its role as innovator.

This is the first of a series of articles based on a study: *Problems of Financing and Managing New Research-Based Enterprises in New England.* The second article will discuss problems of financing. The study was conducted by Albert H. Rubenstein, Assistant Professor of Industrial Management, Massachusetts Institute of Technology, with the aid of a research grant from the Federal Reserve Bank of Boston. Copies of the complete study can be obtained from the bank's Department of Research and Statistics.

There is some doubt that these companies are filling their role as innovators even in their government work. Although contracting authorities recognize that this type of firm can often come up with unique solutions to military problems, they admit they frequently do not take the gamble. The procurement agents would prefer to contract with a firm which they are certain will come up with a workable solution rather than one which might produce a radically new solution. In cases in which a radical solution is needed, the small firm must demonstrate it has the necessary talent and resources to carry through different attempts if one approach fails.

The cost of submitting bids works a particular hardship on the small firm. Several reported having to prepare many proposals for each project. A few expensive failures spell disaster for the small firm.

The biggest problem in contracting remains, however, in adjusting to the time when government contracts are no longer available in the firm's particular field. Many have plans to shift to a commercial market, but the cost of transition is high. Firms producing very specialized military equipment may have more trouble than those possessing more general capabilities. As an official of one firm expressed it: "When our government business tapered off, we felt that we did not want to dissolve our technical staff. We bought into two small companies which were based on the skills possessed by our technical staff."

One firm doing government work is looking for another company to provide it with a marketable product: "We are now 100 per cent in government work. We are looking for diversification in the electronics field. Our criteria are that the firm we acquire has a product and some technical talent related to it."

Role in the New England Economy

Research is particularly important to New England which is dependent on new technology for its economic growth. The contribution of small research-based firms to the New England economy will depend on the extent to which they increase employment.

Most of the new jobs in the region are in industries with large research expenditures. A survey by the Federal Reserve Bank of Boston showed that 85 per cent of New England's expansion in manufacturing employment between 1950 and 1955 was in the six industries with the largest research and development expenditures. In 1955, 30 per cent of New England's manufacturing (computed by value added) was in products developed since World War II.

The mere existence of a large number of small research-based firms does not mean they are playing a more important role in this growth than the large firms. The small firm will be economically important only if it grows and carries out actual production in the region.

So far only a small percentage of the firms have reached the stage where they represent a significant increment to total employment. Most of them are not yet at the stage of large-scale manufacturing.

In the electronics business New England got an early start as the result of heavy concentration of scientific and engineering talent at the end of the war. Despite the early start, few are currently among the largest in the industry. A recent survey by *Fortune* magazine shows only two such firms in this field in New England with sales over $25 million.

The instrument field is generally viewed as a natural area for the scientific and engineering skills of New England. There was a period when New England firms led the way in certain fields of instrumentation, but no longer do so. Instrument firms in other regions have been moving into the industry, and in many cases growing more rapidly than New England firms which once were the leaders.

One reason for some of these firms' failure to develop within New England is merger. Sometimes when the small firm is absorbed by a larger firm outside the region, actual production is not carried on in New England. One large corporation said it acquired a research enterprise in New England for technical talent only, and intended to operate it solely as a research and development facility.

Many New England firms have built a reputation in the components industry, but few have been able to penetrate for long the mass markets for components going into the millions of consumer products. In this end of the business, production capacity and price competition are the important factors. These new, small businesses with limited capital resources and limited mass-production know-how are at a competitive disadvantage wherever they may be located.

Because of the lag in developing and marketing research type products, it is still too early to evaluate the success of these postwar research-based firms. It is clear, however, that the mere existence of the firms will not substantially contribute to New England employment. They will only be successful in this respect if they can be encouraged to develop and maintain their production facilities in the region.

Business Loan Rates, 1946-1957

Since World War II, the greatest rise in interest rates paid by business borrowers at New England banks was for the largest loans. Furthermore, the rates rose more at large than at small banks. At least this was the situation at the peak of the 1957 boom period. Since then, of course, rates have probably fallen at all banks.

These are among the findings of three postwar business loan surveys of the Federal Reserve System. The surveys, made in the fall of 1946, 1955, and 1957, included both secured and unsecured loans of all maturities made to business borrowers by the commercial loan or instalment loan departments of the region's banks.

In the surveys of 1946 and 1955, average rates for each size of borrower were almost identical at large, medium, and small banks. But between 1955 and 1957 a spread developed. The sharpest rise was at the large banks, but medium size banks had larger increases than small banks.

The general explanation for sharp rises in larger loans at the larger banks in the district has several components. The relatively lower rate on large loans in 1946 set the stage for sharper percentage increases. The general increase in demand for funds in relation to the restricted supply put upward pressure on all interest rates during periods when credit policy was restrictive, particularly 1951-53 and 1955-57.

An additional explanation for the interest rate changes is found in the nature of the 1955-57 boom. The period was marked by a high level of expenditures on capital equipment. Large corporations, which account for most of this type of spending, liquidated a substantial part of their holdings of U. S. Government securities and other money market instruments. Many corporations turned to the capital markets for funds, and yields were pushed far above previous postwar highs. This caused many firms to use bank credit for expansion, with the hope of refunding these loans later at lower rates.

Capital expenditure programs usually involve large outlays, and loans for this purpose are concentrated in the large size classes. The smaller banks are limited in their ability to provide large loans, and this results in concentration of demands among larger banks.

In the First District business loans at large banks rose 23 per cent from 1955 to 1957. The rise was only 14 per cent at medium and small banks. This greater loan demand at larger banks, coupled with generally tight money supplies, drove up the large banks' interest rates more than the average.

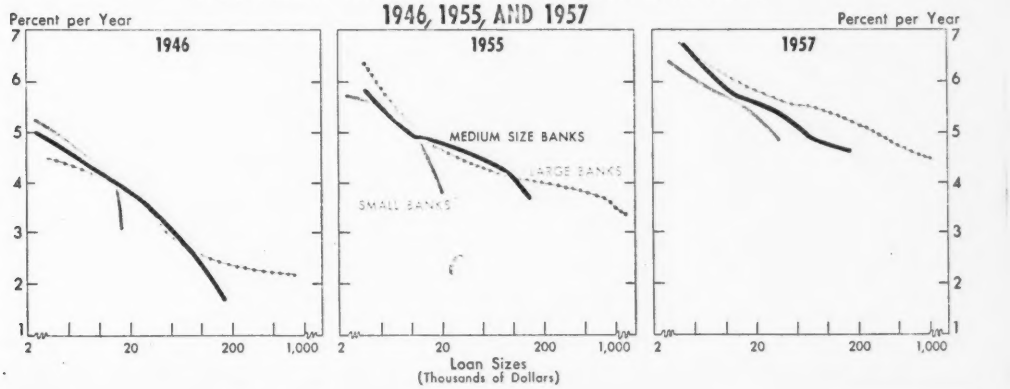
Borrowers in all size categories felt the pressure on the large banks. Generally, large loans carry lower rates than small loans. In 1956-57, however, even when loans were large, businesses paid higher rates at large banks than at medium and small banks. (See table on page 6.)

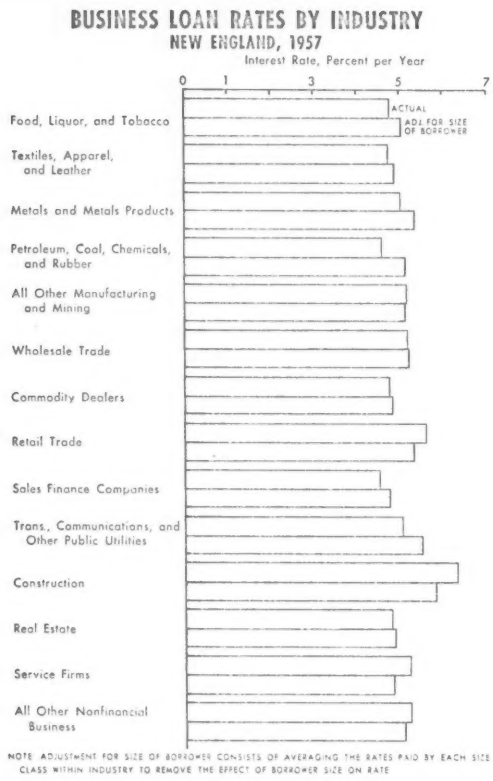
Rates by Loan Size

Rates on the largest loans were near the prime business loan rates in the last two surveys, but were generally higher than the prime rate in 1946. The prime rate rose from 3 to 3¼ per cent just prior to the 1955 survey, from 4 to 4½ per cent before the 1957 survey, and was 1½ per cent in 1946.

In 1946 both large and small banks had a spread between the prime rate and the rate on the largest loans. At large banks the principal reason for the spread was longer maturities.

BUSINESS LOAN RATES IN NEW ENGLAND





Almost two-thirds of their business loans had maturities of over a year, and these longer-term loans carry higher interest rates. Small banks, lending mostly to small borrowers in 1946, made few loans to businesses eligible for the prime rate. Funds were so plentiful in 1946 that large borrowers did not have to tap the small bank sources. Rates on the smallest loans rose on the average, but shifted position between large and small banks in the region. In 1946, these rates were lower at large banks than at small banks. By 1955, they were lower at small banks.

The rise in the average rate on the smallest loans reflects in large part the growth in instalment lending for business purposes. Instalment loans are usually made on a discount basis, which results in an effective charge almost double the stated rate. Even in 1957 the stated rate rarely exceeded 6 per cent.

Average rates on business loans in New England were almost identical to those in the nation in 1957. In 1946 and 1955 New England rates averaged about ¼ per cent below the nation for all except the largest loans.

Generally loanable funds are more plentiful in the First District. This has been reflected in both real estate and business loan rates. The high level of demand for bank credit by businesses in the 1955-57 boom, however, tended to equalize business loan rates between regions.

Rates by Industry

Average rates by industry of borrower varied from 4.55 per cent per year for sales finance companies to 6.33 per cent for construction concerns. Rate differences by industry largely reflect differences in borrower and loan sizes, and in risk.

Shown in the chart on this page is a comparison of actual average 1957 rates by industry and rates adjusted for borrower size, which is the rate which would prevail if all borrowing industries had the same size distribution. When this adjustment is made, loan rate variations among industries are narrowed from a spread of almost 2 percentage points to a spread of about 1 point.

Sales finance companies continue to have the lowest rate on the adjusted basis, about ½ of a percentage point below the average, while construction firms still have the highest, about ¾ of a point above the average.

The single group which had the highest average rate in 1957 at 11.84 per cent was the unincorporated public utility and transportation group in the unknown asset size classification. This specific group consists mainly of taxi and truck operators. The level of the average interest rate suggests that their loans were obtained from the instalment loan department on conditional sales contract paper secured by the motor vehicle being purchased.

AVERAGE RATES AND SIZES OF BUSINESS LOANS IN NEW ENGLAND, 1957

Borrower Size	Small Banks (Up to $10 million of deposits)	Medium-size Banks ($10-100 million of deposits)	Large Banks (Over $100 million of deposits)
	(Interest Rates in Per Cent Per Year)		
Under $50,000			
Average interest rate	6.36	6.73	6.63
Average loan size	$2,900	$4,050	$4,500
$50,000-$250,000			
Average interest rate	5.76	5.71	5.74
Average loan size	$8,050	$13,000	$19,200
$250,000-$1,000,000			
Average interest rate	5.29	5.36	5.45
Average loan size	$19,400	$35,400	$72,500
$1,000,000-$5,000,000			
Average interest rate	4.77	4.92	4.96
Average loan size	$35,000	$66,000	$300,000
$5,000,000-$25,000,000			
Average interest rate	*	4.65	4.65
Average loan size	*	$179,000	$525,000
$25,000,000-$100,000,000			
Average interest rate	*	4.35	4.43
Average loan size	*	$245,000	$1,070,000
Over $100,000,000			
Average interest rate	*	*	4.42
Average loan size	*	*	$1,450,000

* Too few loans made to compute reliable average.

Automobile Sales Falling Near 10-Year Low

Automobile sales, which have been slipping since the boom period of 1955, are getting close to a 10-year low for 1958.

Sales in the first five months of this year ran some 23 per cent below the comparable period last year. At this rate, sales for the year would dip below 5,000,000 for the first time since 1952, when materials restrictions curtailed output. If 1952 is excluded, sales may drop to the lowest level since 1948, when only 3.5 million new cars were sold.

The peak in car buying was reached in 1955, when 7.2 million new cars were registered. In both 1956 and 1957 car registrations were 6 million. Some 425,000 cars were sold in the United States in May of this year, a 24 per cent drop from May, 1957.

The automobile market in New England is running about the same as the rest of the nation. April registrations of new passenger cars in New England were down 19 per cent from a year ago. The decline in Massachusetts was 21 per cent.

Sales rose in the spring, but the increase is no more than normal seasonal expectations. Between March and April new car registrations rose 34 per cent in New England, compared to a rise of 27 per cent in the same period last year.

As of June 1, new car inventories as estimated by *Automotive News,* had declined nationally to 728,864 from a May 1 figure of 779,745. The gradual decline in stocks is attributed primarily to production cuts which will reduce output for the first half of the year to about 2.2 million cars. In the opinion of automobile dealers, there should be little difficulty in clearing out 1958 models when the annual clean-up time rolls around in July.

One remedy which will be adopted to curtail production of 1958 models is the alteration in the starting date of the model changeover period. The changeover will be one to three months earlier than in 1957 and shutdowns for retooling will be spread out over a longer period. Initial production of 1959 models will be below usual output.

The question most asked by dealers and manufacturers is: "Why the lack of interest in new car buying?" Several reasons have been offered to account for the slump. One is that the present recession caused potential buyers to hold back from purchasing large, expensive items. A decline in car purchases was at least partly a cause of the recession, however, and other reasons for the lack of interest in new cars must be sought.

Another cause of the car slump is prices. Since 1947 car prices have risen 42 per cent, twice as much as the rise in other consumer prices. Between 1957 and 1958 alone the prices of new automobiles advanced 3 per cent.

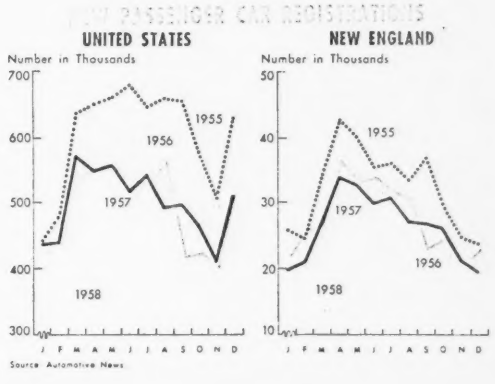
Other reasons given for lowered new car sales include: a good supply of used cars, increased availability and acceptance of imported cars, overselling in 1955, and unpopularity of styles and sizes of 1958 models. If changes in taste have lowered the market for present models, no consolation can be derived from information available on 1959 models. Owing partly to the long time lag in preparing for new models, manufacturers are tooled up to make cars not radically different in appearance from this year's models.

Automobile manufacturers give still another reason for the fall in sales: talk of a cut in the 10 per cent excise tax on new cars. They believe potential customers postponed purchases in hope that lower taxes would make them cheaper.

Easing of Credit Terms

Credit terms for auto sales in the region have tended to ease somewhat in the last two years. This easing is not nearly as marked, however, as that which occurred during 1955.

Currently the proportion of auto instalment loans with 3-year maturities is about 60 per cent—about 5 percentage points higher than in early 1956 and 1957. Down payments as a percentage of selling price have declined. Thus far in 1958, about two-thirds of auto contract loans had down payments of 33 per cent or more. In early 1956 and 1957, three-fourths of the contracts had this large a down payment. Contracts with down payments of 25 per cent or less have increased from 5 per cent in 1956 and 1957 to the current rate of almost 10 per cent.



MANUFACTURING INDEXES (seasonally adjusted)	MASSACHUSETTS (1950–52 = 100)			NEW ENGLAND (1950–52 = 100)			UNITED STATES (1947–49 = 100)		
		Per Cent Change from:			Per Cent Change from:			Per Cent Change from:	
	May '58	April '58	May '57	May '58	April '58	May '57	May '58	April '58	May '57
All Manufacturing	101	+ 6	−11	101	+ 2	−14	129	+ 1	−11
Primary Metals	86	+ 4	−23	70	0	−33	91	+ 6	−31
Textiles	47	0	−10	64	0	− 7	n.a.	n.a.	n.a.
Shoes and Leather	98	+ 9	−18	96	+ 7	−15	n.a.	n.a.	n.a.
Paper	95	− 1	−12	112	− 3	− 5	n.a.	n.a.	n.a.

	NEW ENGLAND			UNITED STATES		
		Per Cent Change from:			Per Cent Change from:	
	May '58	April '58	May '57	May '58	April '58	May '57
BANKING AND CREDIT						
Commercial Loans ($ millions) (Weekly Reporting Member Banks)	1,456	− 3	− 6	29,513	− 2	− 5
Deposits ($ millions) (Weekly Reporting Member Banks)	4,327	− 1	+ 4	98,821	0	+ 6
Check Payments ($ millions) (Selected Cities)	7,656	− 1	+ 6	195,100	− 4	− 1
Consumer Installment Credit Outstanding (index, 1950–52 = 100)	225	+ 1	+ 3	222	0	+ 3
TRADE						
Department Store Sales (index, seas. adj. 1947–49 = 100)	117	+ 3	− 5	133	+ 2	− 1
EMPLOYMENT, PRICES, MAN-HOURS, & EARNINGS						
Nonagricultural Employment (thousands)	3,435	+ 1	− 5	50,496	+ 1	− 4
Insured Unemployment (thousands) (excl. R. R. and Veterans programs)	245	− 9	+113	3,081	− 9	+121
Consumer Prices (index, 1947–49 = 100)	125.8 (Mass.)	0	+ 4	123.6	0	+ 3
Production-Worker Man-Hours (index, 1950 = 100)	77.4	− 1	−15	86.8	0	−15
Weekly Earnings in Manufacturing ($)	74.30 (Mass.)	+ 1	+ 1	81.24	+ 1	− 1
OTHER INDICATORS						
Construction Contract Awards ($ thousands) (3-mos. moving averages, Mar., Apr., May)						
Total	165,471	+30	− 2	3,001,607	+19	− 3
Residential	51,637	+35	−24	1,218,984	+20	+ 1
Public Works	45,214	+76	+47	588,187	+25	+ 7
Electrical Energy Production (index, seas. adj. 1947–49 = 100)*	184.0	+ 1	+ 3	226.9	+ 1	+ 2
Business Failures (number)	65	−38	+35	1,341	− 8	+12
New Business Incorporations (number)	732	+ 5	− 6	11,943	+ 5	− 2

*Figure for last week of month

n.a. = not available